

Algebra 1

Some Algebra 1 standards are intended to cover many parts of the outline, if not the entire course, and, as such, are listed in several places in the content outline.

Course Description

Algebra 1 course competencies are presented for a one-year traditional or one-semester block course that meets the state Algebra 1 standards. The Algebra 1 end-of-course test will be given at the completion of the course.

The course includes

- the use of symbolic reasoning to represent mathematical situations, to express generalizations, and to study relationships among quantities;
- the use of functions to represent and model problem situations, as well as to analyze and interpret relationships;
- the setting up of equations in a wide range of situations and the use of a variety of methods to solve the equations; and
- the use of problem solving, representation, reasoning and proof, language and communication, and connections both within and outside mathematics.

In Algebra 1, handheld graphing calculators are required as part of instruction and assessment. Students should use a variety of representations (e.g., concrete, numerical, algorithmic, graphical), tools (e.g., matrices, data), and technologies to model mathematical situations in order to solve meaningful problems. Technologies include, but are not limited to, powerful and accessible handheld calculators, as well as computers with graphing capabilities.

It is recommended that class size be no larger than twenty-five students.

Recommended Prerequisites

Students entering this course should have mastered all state-mandated eighth-grade standards.

Course Outline

This outline of Algebra 1 includes all of the standards that are eligible for end-of-course testing. Boldfaced items are not eligible for end-of-course testing; however, they are recommended as additional topics for the honors-level course.

- I. Generalizations, algebraic symbols, and matrices.
 - A. Represent very large and very small numbers. **Algebra 1: I.C.1.**
 1. Exponential form.
 2. Scientific form (interpreting calculator display).

- B. Use unit analysis to check measurement computations of English and metric units (e.g., 5 miles per hour = x feet per second). **Algebra 1: I.C.2.**
 - C. Make judgments about the appropriateness of units of measure within a system and between systems. **Algebra 1: I.A.5.**
 - D. Determine patterns from real-life situations and represent generalizations algebraically. **Algebra 1: I.C.3.**
 - E. **Represent union and intersection of sets using Venn diagrams.**
 - F. Recognize and justify the effects of such operations as multiplication, division, and computing powers and roots on the magnitudes of quantities. **Algebra 1: I.C.5.**
 - G. Identify and use properties related to operations with matrices. **Algebra 1: I.C.6.**
 - 1. Addition.
 - 2. Subtraction.
 - 3. Scalar multiplication.
 - H. Solve applied problems using matrices. **Algebra 1: I.C.6.**
- II. Algebraic expressions in problem-solving situations.
- A. Find specific function values and evaluate expressions. **Algebra 1: I.D.1.**
 - B. Use patterns to generate the laws of exponents. **Algebra 1: III.B.1.**
 - 1. Multiplication.
 - 2. Division.
 - 3. Power raised to a power.
 - C. Apply the laws of exponents in problem situations. **Algebra 1: III.B.1.**
 - D. Simplify.
 - 1. Polynomial expressions using **Algebra 1: I.D.2.**
 - a. Addition.
 - b. Subtraction.
 - c. Multiplication.
 - d. Division by monomial.
 - 2. **Rational expressions using**
 - a. **Addition.**
 - b. **Subtraction.**
 - E. Identify the steps to simplify algebraic expressions using properties. **Algebra 1: I.D.6.**
 - 1. Commutative.
 - 2. Associative.
 - 3. Distributive.
 - F. Use symbolic representation and reasoning to verify statements about numbers. **Algebra 1: I.C.4.**
 - G. Investigate factoring techniques. **Preliminary to Algebra 1: I.D.3.**
 - 1. Greatest common factor.
 - 2. Difference between squares.
 - 3. Quadratic trinomial.
 - 4. Grouping.
 - H. Given a problem situation, determine the type of solution needed and an appropriate technique. **Algebra 1: I.D.4.**

1. A rough estimate.
2. An approximation.
3. An exact answer.
- I. Select a suitable method of computing. **Algebra 1: I.D.4.**
 1. Mental mathematics.
 2. Paper-and-pencil combinations.
 3. Calculators.
 4. Computers.
- III. Relationships.
 - A. Describe independent and dependent quantities in functional relationships.
Algebra 1: I.A.1.
 - B. Make judgments about units of measure and scales within a system and between systems. **Algebra 1: I.A.5.**
 - C. Interpret and make inferences from explicit and recursive functional relationships. **Algebra 1: I.A.6.**
- IV. Equations and inequalities.
 - A. Represent relationships among quantities. **Algebra 1: I.A.2.,4.; II.A.1.,3.**
 1. Representations.
 - a. Concrete models.
 - b. Tables.
 - c. Graphs.
 - d. Diagrams.
 - e. Verbal descriptions.
 - f. Equations.
 - g. Inequalities.
 - h. Determine if the situation can be represented by a linear function.
 2. Tools.
 - a. Computer Algebra Systems (CAS).
 - b. Spreadsheets.
 - c. Graphing calculators.
 - B. Analyze problem situations. **Algebra 1: I.A.3.; II.C.1.**
 1. Describe functional and recursive relations.
 2. Write equations.
 3. Write inequalities.
 - C. Transform and solve linear equations and inequalities using
Algebra 1: II.C.2.,3.
 1. Properties.
 - a. Commutative.
 - b. Associative.
 - c. Distributive.
 - d. Equality.
 2. Forms.
 - a. One-step.
 - b. Multi-step.
 3. Models, including graphs.

D. For given contexts, use concrete models to interpret and determine the reasonableness of solutions to linear equations and inequalities.

Algebra 1: II.C.4.

E. Use supporting data to explain why a solution is mathematically reasonable.

Algebra 1: I.D.5.

V. Interpretations.

A. Develop the concept of slope as a rate of change, and determine slope in different representations. **Algebra 1: II.B.1.**

1. Graphs.
2. Tables.
3. Algebraic representations.

B. Interpret the meaning of slope and intercepts in different situations involving

Algebra 1: II.B.2.

1. Data analysis.
2. Symbolic representations.
3. Graphs.

C. With and without a graphing calculator, investigate, describe, and predict the effects of changes in m and b on the graph of $y = mx + b$ and the results of these changes in applied situations. **Algebra 1: II.B.3.,6.**

D. Graph and write equations of lines with given characteristics. **Algebra 1: II.B.4.**

1. Two points.
2. One point and a slope.
3. A slope and y-intercept.

E. Determine the intercepts of linear functions in different representations.

Algebra 1: II.B.5.

1. Graphs.
2. Tables.
3. Algebraic representations.

F. Develop and graph the absolute value function.

G. Determine the intercepts of the absolute value function from the

- 1. Graph.**
- 2. Table.**
- 3. Algebraic representation.**

H. Relate direct variation to linear functions, and solve problems involving proportional change. **Algebra 1: II.B.7.**

VI. Linear functions and data representations.

A. For a variety of situations, identify and determine reasonable domain and range values. **Algebra 1: I.B.2; II.A.2.**

B. Match situations to given graphs, and justify or interpret the match.

Algebra 1: I.B.3.

C. Create situations that fit given graphs. **Algebra 1: I.B.3.**

D. Represent, display, and interpret data, including representations on graphing calculators and computers. **Algebra 1: I.B.4.**

1. Scatter plots.
2. Bar graphs.

3. Stem-and-leaf plots.
 4. Box-and-whiskers diagrams.
 - E. Write a linear equation that fits a data set, check the model for “goodness of fit,” and make predictions using the model. **Algebra 1: I.B.5.**
- VII. Systems of linear equations.
- A. Analyze situations and formulate systems of linear equations to solve problems. **Algebra 1: II.D.1.**
 - B. Solve systems of linear equations using **Algebra 1: II.D.2.**
 1. Concrete models.
 2. Graphs.
 3. Tables.
 4. Algebraic methods (e.g., elimination, substitution).
 5. Technology, including CAS, spreadsheets, and graphing calculators.
 - C. For given contexts, interpret and determine the reasonableness of solutions to systems of linear equations. **Algebra 1: II.D.3.**
- VIII. Linear and quadratic functions and data representations.
- A. Identify the parent functions. **Algebra 1: I.B.1.**
 1. Linear ($y = x$).
 2. Quadratic ($y = x^2$).
 - B. Sketch the parent functions. **Algebra 1: I.B.1.**
 1. Linear ($y = x$).
 2. Quadratic ($y = x^2$).
- IX. Quadratic functions.
- A. Determine the domain and range values for quadratic functions given the constraints of the problem. **Algebra 1: III.A.1.**
 - B. With and without using a graphing calculator, investigate, describe, and predict the effects of changes in
 1. Constant a on the graph of $y = ax^2$. **Algebra 1: III.A.2.**
 2. Constant c on the graph of $y = x^2 + c$. **Algebra 1: III.A.3.**
 - C. For problem situations, analyze graphs of quadratic functions and draw conclusions. **Algebra 1: III.A.4.**
 - D. Solve quadratic equations using **Algebra 1: I.D.3.; III.A.5.**
 1. Concrete models.
 2. Tables.
 3. Graphs.
 4. Algebraic methods that include factoring and using the quadratic formula, as well as CAS, spreadsheets, and graphing calculators.
 - E. Relate the solutions of quadratic equations to the roots of the function. **Algebra 1: III.A.6.**
- X. Other functions.
- A. **Develop, interpret, and graph the square root function.**
 - B. Analyze data and represent situations appropriately. **Algebra 1: III.B.2., 3.**
 1. Functions.
 - a. Inverse variation.
 - b. Exponential growth and decay.

2. Representations.
 - a. Concrete models.
 - b. Tables.
 - c. Graphs.
 - d. Algebraic methods as well as CAS, spreadsheets, and graphing calculators.